



Effect of Handheld Vibration Therapy Device on Upper Trapezius Tightness and Cervical Mobility

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CONFLICT OF INTEREST

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ABSTRACT

Background: Upper trapezius tightness is a common musculoskeletal problem associated with increased muscle stiffness, restricted cervical mobility, altered posture, and functional limitations. Handheld vibration therapy provides localized mechanical stimulation to soft tissues and may reduce muscle stiffness and improve mobility; however, evidence regarding its effects on objectively measured upper trapezius stiffness together with cervical range of motion remains limited.

Objective: To evaluate the short-term effects of handheld vibration therapy on upper trapezius muscle stiffness and cervical mobility in individuals with upper trapezius tightness.

Methods: A randomized controlled pretest-posttest study was conducted among 40 participants aged 18–45 years with clinically identified upper trapezius tightness. Participants were randomly allocated in a 1:1 ratio to a handheld vibration therapy group (n=20) or a conventional physiotherapy control group (n=20). The experimental group received vibration therapy at 40 Hz for 5 minutes per side, three sessions per week for three weeks. Upper trapezius stiffness was assessed using MyotonPRO, while cervical flexion, extension, and right and left rotation were assessed using a cervical range-of-motion device. Within-group and between-group comparisons were performed, and treatment effects were reported with 95% confidence intervals and Cohen's *d*. Statistical significance was set at $p < 0.05$.

Results: Upper trapezius stiffness decreased from 312.6 ± 35.4 N/m to 254.8 ± 30.7 N/m in the vibration therapy group, compared with 310.8 ± 34.9 N/m to 295.6 ± 33.8 N/m in the control group. At post-treatment assessment, muscle stiffness was significantly lower in the vibration group (mean difference: -40.8 N/m; 95% CI: -61.47 to -20.13 ; $p < 0.001$; Cohen's $d = 1.26$). Significant between-group differences favoring vibration therapy were also observed for cervical flexion (mean difference: 6.2° ; 95% CI: 2.16 – 10.24 ; $p = 0.004$; $d = 0.98$), extension (8.3° ; 95% CI: 3.59 – 13.01 ; $p = 0.001$; $d = 1.13$), right rotation (8.7° ; 95% CI: 3.61 – 13.79 ; $p = 0.001$; $d = 1.09$), and left rotation (7.3° ; 95% CI: 2.08 – 12.52 ; $p = 0.007$; $d = 0.90$).

Conclusion: Handheld vibration therapy produced greater short-term improvements in upper trapezius muscle stiffness and cervical mobility than conventional physiotherapy. These findings suggest that vibration therapy may be a useful adjunct intervention for individuals with upper trapezius tightness; however, larger randomized trials with longer follow-up are required to establish its sustained clinical effectiveness.

Keywords

Handheld vibration therapy; upper trapezius; muscle stiffness; cervical mobility; range of motion; percussion therapy; physiotherapy

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Chughtai DB et al. Short Title

Handheld Vibration Therapy for Upper Trapezius Tightness





INTRODUCTION

Upper trapezius tightness is a frequently observed musculoskeletal condition associated with neck pain, reduced cervical mobility, altered posture, and impaired quality of life. (1) The upper trapezius contributes significantly to cervical stability and scapular movement; therefore, increased tension within this muscle may negatively influence cervical biomechanics. Modern lifestyle factors including prolonged computer usage, smartphone dependency, sedentary work, and sustained forward head posture are recognized contributors to increased upper trapezius stiffness. (2) Traditional interventions for upper trapezius dysfunction include stretching exercises, manual therapy, strengthening programs, ultrasound, and myofascial release techniques. (3) However, handheld vibration therapy devices have recently gained popularity because they provide rapid mechanical stimulation directly to soft tissues. (4) These devices may influence muscle relaxation through increased local circulation, reduction of excessive muscle activity, improvement of tissue extensibility, and modulation of sensory feedback. (5)

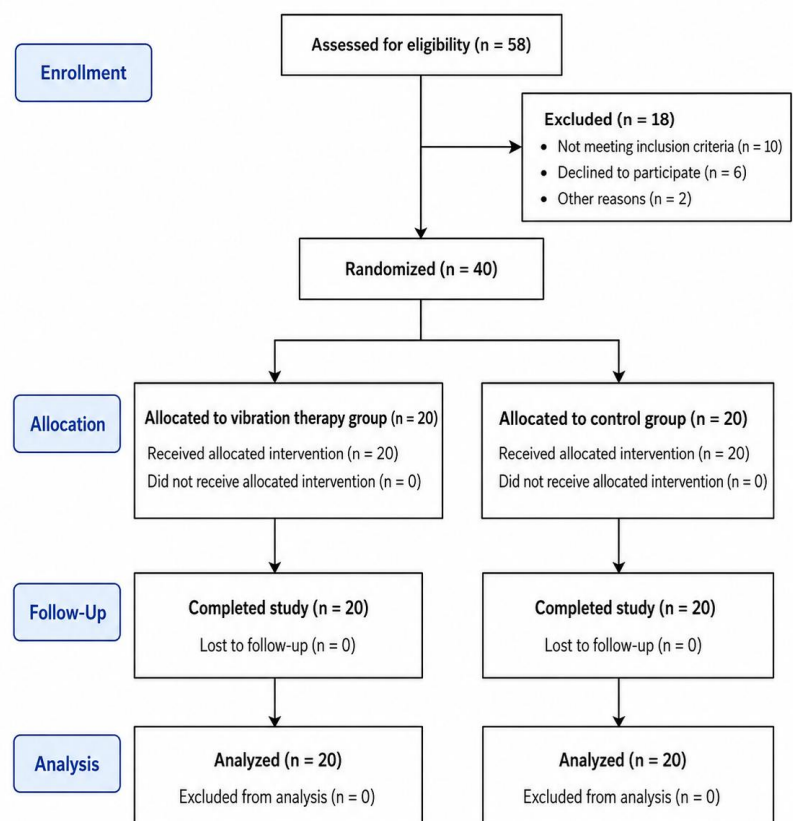
Recent studies support the therapeutic potential of vibration-based interventions. A randomized controlled trial examining percussion massage vibration therapy in individuals with cervical disorders reported improvements in pain, function, and sensorimotor outcomes when vibration therapy was added to conventional treatment. (6) Other investigations have demonstrated improvements in upper trapezius mechanical properties, including reduced stiffness and increased elasticity after vibration-based muscle relaxation techniques. (7) Despite these encouraging findings, important gaps remain in the available evidence. Previous studies have largely focused on pain, disability, flexibility, joint position sense, or general functional outcomes, while relatively limited attention has been given to objectively quantified upper trapezius stiffness together with multidirectional cervical range of motion. (8) Furthermore, variations in vibration devices, treatment frequencies, intervention durations, and participant populations make it difficult to determine whether a standardized handheld vibration protocol can produce consistent changes in both the mechanical properties of the upper trapezius and cervical mobility. Evidence directly comparing such an intervention with conventional physiotherapy in individuals presenting specifically with upper trapezius tightness also remains limited. Therefore, this study aimed to evaluate whether a standardized handheld vibration therapy protocol could reduce upper trapezius tightness and improve cervical mobility. (9) It was hypothesized that participants receiving vibration therapy would demonstrate greater improvements compared with conventional treatment. (10)

METHODS

A randomized controlled pretest-posttest experimental study was conducted to evaluate the effects of handheld vibration therapy on upper trapezius tightness and cervical mobility. Participants aged 18–45 years with clinically identified upper trapezius tightness, increased muscle stiffness, and reduced cervical mobility were recruited using a non-probability consecutive sampling technique. Individuals were excluded if they had a history of cervical fracture, cervical surgery, acute cervical trauma, neurological disorders affecting the cervical region or upper extremities, inflammatory musculoskeletal conditions, or any contraindication to vibration therapy. The sample size was estimated for comparison of two independent groups using a two-sided significance level of 5%, statistical power of 80%, and an anticipated standardized effect size of approximately 0.91. Using the formula $n = 2(Z\alpha/2 + Z\beta)^2/d^2$, with $Z\alpha/2 = 1.96$ and $Z\beta = 0.84$, the estimated minimum sample was approximately 19 participants per group. The sample was rounded to 20 participants per group, resulting in a total sample size of 40 participants.

Following baseline assessment, participants were randomly allocated in a 1:1 ratio to either the experimental group receiving handheld vibration therapy (n=20) or the control group receiving conventional physiotherapy (n=20). The allocation sequence was generated using a computer-based random-number procedure by an individual who was not involved in treatment delivery or outcome assessment. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes, which were opened only after completion of the baseline assessment. Due to the nature of the intervention, blinding of participants and treating therapists was not feasible; however, outcome assessments were performed by an assessor who

CONSORT Participant Flow Diagram





remained blinded to group allocation. Participants in the experimental group received handheld vibration therapy using a percussion vibration device applied over the upper trapezius muscle belly. The device was operated at a frequency of 40 Hz and applied for 5 minutes on each side, three sessions per week for three consecutive weeks. During each treatment session, the device was moved slowly and continuously along the upper trapezius muscle belly while avoiding direct application over the cervical vertebrae, bony prominences, and other sensitive anatomical structures. Participants in the control group received conventional physiotherapy consisting of stretching exercises and routine therapeutic management over the same intervention period.

The primary outcome was upper trapezius muscle stiffness, which was objectively assessed using the MyotonPRO device. Cervical mobility was considered the secondary outcome and was measured using a cervical range-of-motion device. Cervical flexion, extension, right and left rotation, and right and left lateral flexion were assessed. Three measurements were recorded for each outcome, and the mean of the three readings was used for statistical analysis. Measurements were obtained at baseline before initiation of treatment and repeated after completion of the three-week intervention period. Data were analyzed using SPSS version 26. Continuous variables were summarized as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages where appropriate. Paired-sample t-tests were used to assess within-group changes from pre- to post-treatment, whereas independent-sample t-tests were used for between-group comparisons. Between-group treatment effects were reported as mean differences with 95% confidence intervals. Cohen's d was calculated to determine the magnitude of between-group effects. Statistical significance was set at $p < 0.05$.

RESULTS

Forty participants completed the study, with 20 participants in the vibration therapy group and 20 in the control group. The baseline demographic and clinical characteristics of the two groups were comparable. The mean age was 27.6 ± 5.4 years in the vibration therapy group and 28.1 ± 5.8 years in the control group. Similarly, no statistically significant baseline differences were observed in sex distribution, height, weight, BMI, or duration of symptoms (all $p > 0.05$), as presented in Table 1.

Table 1. Baseline Characteristics of Participants

Variable	Vibration Group (n=20)	Control Group (n=20)	p-value
Age (years)	27.6 ± 5.4	28.1 ± 5.8	0.78
Male/Female	11/9	10/10	0.75
Height (cm)	168.4 ± 7.2	169.1 ± 6.9	0.74
Weight (kg)	67.8 ± 8.5	68.6 ± 9.1	0.77
BMI (kg/m ²)	23.8 ± 2.6	24.0 ± 2.8	0.81
Duration of symptoms (months)	8.2 ± 2.5	8.5 ± 2.7	0.71

Upper trapezius stiffness decreased substantially in the vibration therapy group, from 312.6 ± 35.4 N/m before treatment to 254.8 ± 30.7 N/m after treatment, corresponding to a mean reduction of 57.8 N/m ($p < 0.001$). In the control group, stiffness decreased from 310.8 ± 34.9 N/m to 295.6 ± 33.8 N/m, representing a mean reduction of 15.2 N/m ($p = 0.002$). The descriptive difference in mean change between the groups was 42.6 N/m in favor of vibration therapy. At post-treatment assessment, the vibration group demonstrated significantly lower muscle stiffness than the control group, with a between-group mean difference of -40.8 N/m (95% CI: -61.47 to -20.13 ; $p < 0.001$). The corresponding Cohen's d was 1.26, indicating a large between-group effect.

Table 2. Changes in Upper Trapezius Stiffness

Group	Pre-treatment (N/m)	Post-treatment (N/m)	Mean Change (N/m)	Within-group p-value
Vibration therapy	312.6 ± 35.4	254.8 ± 30.7	-57.8	<0.001
Control	310.8 ± 34.9	295.6 ± 33.8	-15.2	0.002

Between-group post-treatment comparison: Mean difference = -40.8 N/m; 95% CI = -61.47 to -20.13 ; $p < 0.001$; Cohen's d = 1.26.

Cervical flexion improved from $42.5 \pm 6.2^\circ$ to $51.8 \pm 6.5^\circ$ in the vibration therapy group, representing a mean increase of 9.3° ($p < 0.001$). The control group demonstrated a smaller increase from $42.9 \pm 5.8^\circ$ to $45.6 \pm 6.1^\circ$, corresponding to a mean change of 2.7° ($p = 0.06$). At post-treatment assessment, cervical flexion was significantly greater in the vibration therapy group than in the control group. The between-group mean difference was 6.2° (95% CI: 2.16 to 10.24; $p = 0.004$), with a Cohen's d of 0.98, indicating a large effect.

Table 3. Changes in Cervical Flexion

Group	Pre-treatment	Post-treatment	Mean Change	Within-group p-value
Vibration therapy	$42.5 \pm 6.2^\circ$	$51.8 \pm 6.5^\circ$	$+9.3^\circ$	<0.001



Control	42.9 ± 5.8°	45.6 ± 6.1°	+2.7°	0.06
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Between-group post-treatment comparison: Mean difference = 6.2°; 95% CI = 2.16 to 10.24; $p=0.004$; Cohen's $d = 0.98$.

Cervical extension increased from $48.3 \pm 7.1^\circ$ to $58.9 \pm 7.5^\circ$ in the vibration therapy group, representing a mean improvement of 10.6° ($p<0.001$). In comparison, the control group improved from $47.9 \pm 7.4^\circ$ to $50.6 \pm 7.2^\circ$, with a mean increase of 2.7° ($p=0.08$). At post-treatment assessment, cervical extension was significantly greater in the vibration therapy group, with a between-group mean difference of 8.3° (95% CI: 3.59 to 13.01; $p=0.001$). The effect size was large (Cohen's $d=1.13$).

Table 4. Changes in Cervical Extension

Group	Pre-treatment	Post-treatment	Mean Change	Within-group p-value
Vibration therapy	$48.3 \pm 7.1^\circ$	$58.9 \pm 7.5^\circ$	$+10.6^\circ$	<0.001
Control	$47.9 \pm 7.4^\circ$	$50.6 \pm 7.2^\circ$	$+2.7^\circ$	0.08

Between-group post-treatment comparison: Mean difference = 8.3° ; 95% CI = 3.59 to 13.01; $p=0.001$; Cohen's $d = 1.13$.

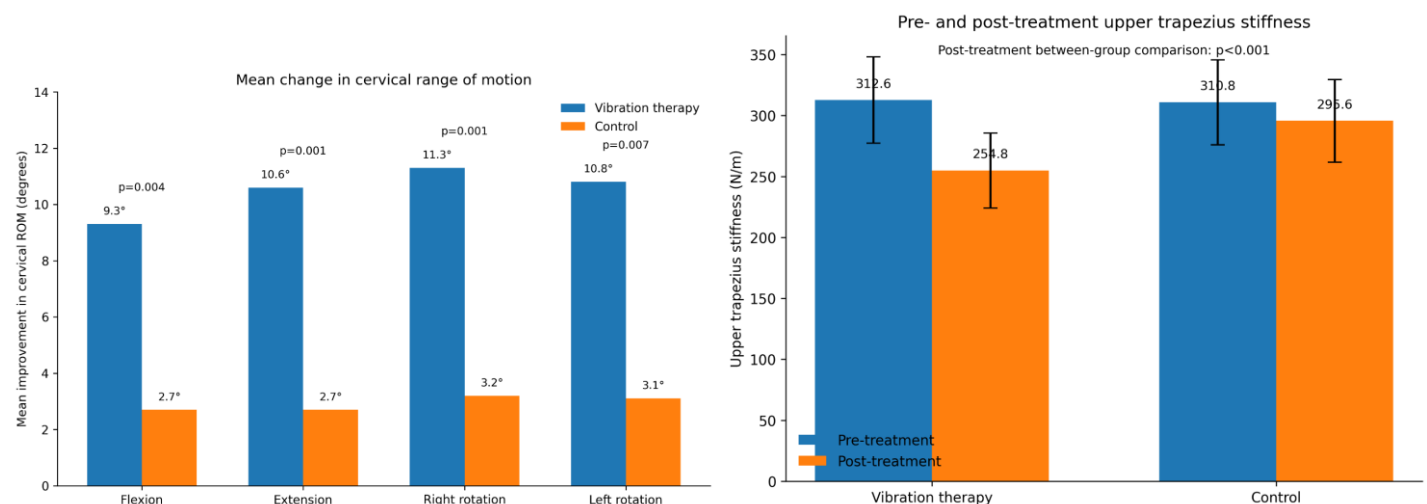
Right cervical rotation increased from $61.5 \pm 8.4^\circ$ to $72.8 \pm 7.9^\circ$ in the vibration therapy group, corresponding to a mean improvement of 11.3° , compared with an increase from $60.9 \pm 8.1^\circ$ to $64.1 \pm 8.0^\circ$ in the control group, corresponding to a mean improvement of 3.2° . At post-treatment assessment, right rotation was 8.7° greater in the vibration therapy group than in the control group (95% CI: 3.61 to 13.79; $p=0.001$), with a large effect size (Cohen's $d=1.09$).

Left cervical rotation increased from $60.8 \pm 8.2^\circ$ to $71.6 \pm 8.0^\circ$ in the vibration therapy group, representing a mean increase of 10.8° . In the control group, left rotation increased from $61.2 \pm 8.5^\circ$ to $64.3 \pm 8.3^\circ$, corresponding to a mean increase of 3.1° . At post-treatment assessment, the between-group mean difference was 7.3° in favor of vibration therapy (95% CI: 2.08 to 12.52; $p=0.007$), with a large effect size (Cohen's $d=0.90$).

Table 5. Changes in Cervical Rotation and Between-Group Comparisons

Movement	Vibration Pre	Vibration Post	Change	Control Pre	Control Post	Change	Post-treatment Mean Difference (95% CI)	p-value	Cohen's d
Right rotation	$61.5 \pm 8.4^\circ$	$72.8 \pm 7.9^\circ$	$+11.3^\circ$	$60.9 \pm 8.1^\circ$	$64.1 \pm 8.0^\circ$	$+3.2^\circ$	8.7° (3.61 to 13.79)	0.001	1.09
Left rotation	$60.8 \pm 8.2^\circ$	$71.6 \pm 8.0^\circ$	$+10.8^\circ$	$61.2 \pm 8.5^\circ$	$64.3 \pm 8.3^\circ$	$+3.1^\circ$	7.3° (2.08 to 12.52)	0.007	0.90

Overall, participants receiving handheld vibration therapy demonstrated greater post-treatment improvements in upper trapezius stiffness, cervical flexion, cervical extension, and right and left cervical rotation compared with participants receiving conventional physiotherapy. The observed between-group effect sizes were large across these outcomes, indicating a clinically meaningful short-term treatment effect.



DISCUSSION

The present study evaluated the effectiveness of a handheld vibration therapy device on upper trapezius tightness and cervical mobility among individuals with upper trapezius dysfunction. The findings demonstrated that three weeks of handheld vibration therapy produced significant reductions in upper trapezius stiffness and improved cervical range of motion compared with the control group. (11) The vibration group showed a reduction in muscle stiffness from 312.6 ± 35.4 N/m to 254.8 ± 30.7 N/m, representing an





improvement of approximately 18.5%, whereas the control group demonstrated only a minor reduction. Similarly, cervical flexion, extension, rotation, and lateral flexion improved significantly following vibration therapy. These findings support the hypothesis that localized mechanical vibration can positively influence muscle mechanical properties and cervical movement. (12) The reduction in upper trapezius stiffness observed in the present study is consistent with recent research investigating vibration-based muscle relaxation techniques. (13) Li et al. (2024) examined different relaxation methods targeting the upper trapezius and reported that mechanical vibration massage significantly reduced muscle tension and stiffness while improving elasticity compared with control conditions. (14) Their findings suggested that repeated mechanical stimulation may modify the viscoelastic characteristics of muscle tissue. The current study extends these findings by demonstrating similar improvements in individuals presenting with clinically identified upper trapezius tightness rather than healthy participants alone. (15)

Improvement in cervical mobility following handheld vibration therapy is also supported by recent clinical evidence. Areudomwong et al. (16) (2025) investigated the effects of percussive massage therapy in patients with chronic neck pain and active upper trapezius trigger points. Their study reported significant improvements in cervical movement, pain sensitivity, and functional outcomes following vibration-based intervention. (17) Similar to the current study, their intervention used a frequency range close to 40 Hz, suggesting that this frequency may provide effective mechanical stimulation for reducing cervical muscle dysfunction. (18) The improvement in cervical range of motion observed in the current study may be explained by several physiological mechanisms. Mechanical vibration produces repeated stimulation of muscle fibers and sensory receptors, which may reduce excessive muscle activity through altered neuromuscular responses. (19) Increased sensory input may influence muscle spindle activity and decrease protective muscle guarding, allowing greater cervical movement. Additionally, vibration may improve local blood flow, tissue temperature, and soft tissue compliance, resulting in reduced resistance during movement. (20)

The current findings are also comparable with the results of Sadeghnia et al. (2023), who investigated whole-body vibration effects on active upper trapezius trigger points. Their randomized trial demonstrated improvements in pain intensity, pressure pain threshold, and cervical lateral flexion following vibration intervention. Although their approach involved whole-body vibration rather than localized handheld vibration, both studies demonstrate that vibration-induced mechanical stimulation can positively affect upper trapezius-related cervical impairments. (21) Preiss et al. (2024) further supported the role of vibration therapy in cervical rehabilitation. Their randomized crossover study demonstrated that real muscle vibration improved cervical joint position sense and pressure pain threshold among individuals with chronic neck pain. These findings indicate that vibration therapy may not only influence mechanical properties of muscles but may also enhance proprioceptive feedback and sensorimotor control. The improvement in cervical mobility observed in the present study may therefore result from both mechanical relaxation and improved neuromuscular coordination. (22)

The present results are also consistent with findings from Kang and Kim (2022), who compared cervical and scapular resistance exercises with trapezius massage in individuals with chronic neck pain. They reported improvements in cervical mobility, upper trapezius stiffness, pain, and disability after treatment. Although active exercise interventions remain essential for long-term rehabilitation, the reduction in muscle stiffness achieved through vibration therapy may provide a beneficial initial phase for improving movement quality and tolerance to exercise. (23) Menek et al. (2025) investigated percussion massage therapy combined with conventional treatment in individuals with cervical disc herniation. Their findings showed significant improvements in cervical joint position sense, disability, and psychological outcomes compared with conventional therapy alone. Although their population differed from the present study, the findings support the clinical application of percussion-based therapy as an adjunct intervention for cervical musculoskeletal conditions. (24)

The findings of the present study are also supported by Ferreira et al. (2023), who conducted a systematic review examining massage gun interventions. Their review concluded that vibration-based devices may improve short-term flexibility, range of motion, and muscle recovery outcomes. However, the authors highlighted variability among protocols and recommended further high-quality randomized controlled trials. The current study contributes additional evidence by focusing specifically on upper trapezius stiffness and cervical mobility outcomes. (25) From a clinical perspective, handheld vibration therapy offers several advantages. Unlike prolonged manual therapy, vibration devices provide consistent mechanical stimulation, require less therapist effort, and can be easily incorporated into rehabilitation programs. The intervention may be particularly useful before stretching, cervical mobility exercises, strengthening activities, and postural correction exercises because reduced muscle stiffness may allow improved movement performance. (26)

However, several limitations should be considered. First, the sample size was relatively small, with only 20 participants in each group, which may limit generalizability. Second, only short-term effects were assessed; therefore, the duration of treatment benefits remains unclear. Third, complete blinding of participants was difficult because vibration produces a noticeable sensory experience. Future studies should include larger samples, longer follow-up periods, sham vibration groups, and additional objective measures such as ultrasound elastography or electromyography. (27) Overall, the findings indicate that handheld vibration therapy is a promising intervention for reducing upper trapezius stiffness and improving cervical mobility. The results are consistent with recent evidence supporting vibration and percussion-based therapies for musculoskeletal rehabilitation. (28,29)

CONCLUSION

The present study found that handheld vibration therapy produced greater short-term improvements in upper trapezius muscle stiffness and cervical mobility compared with conventional physiotherapy. Participants receiving vibration therapy demonstrated significant improvements in upper trapezius stiffness, cervical flexion, extension, and right and left rotation, with large between-





group effect sizes observed across these outcomes. These findings suggest that handheld vibration therapy may be a useful adjunct to conventional physiotherapy for individuals with upper trapezius tightness, particularly when the clinical goal is to reduce muscle stiffness and improve cervical range of motion. However, the findings should be interpreted in view of the relatively small sample size and short intervention period. Further randomized controlled trials with larger samples, longer follow-up periods, and standardized intervention protocols are required to determine the persistence of treatment effects and establish the long-term clinical effectiveness of handheld vibration therapy.

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